

PATENT COOPERATION TREATY

PCT

REC'D 29 SEP 2004

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY PCT (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 84943-EH	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/NO 2003/000205	International filing date (day/month/year) 19.06.2003	Priority date (day/month/year) 21.06.2002
International Patent Classification (IPC) or national classification and IPC B01D 45/12, B04C 3/00, B04C 9/00		
Applicant STATOIL ASA et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand 20.01.2004	Date of completion of this report 21.09.2004
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Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/NO 2003/000205

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

- ☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1-5 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☒ the claims:
- pages _____ as originally filed/furnished
- pages* _____ as amended (together with any statement) under Article 19
- pages* 6-7 _____ received by this Authority on 10.05.2004
- pages* _____ received by this Authority on _____
- ☒ the drawings:
- pages 1-3 _____ as originally filed/furnished
- pages* _____ received by this Authority on _____
- pages* _____ received by this Authority on _____
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/figs _____
- ☐ the sequence listing (*specify*): _____
- ☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/NO 2003/000205

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-5</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-5</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-5</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1. WO 0074815 A2
D2. WO 0025931 A1
D3. US 4650578 A
D4. DE 2256678 A
D5. WO 02056999 A1
D6. WO 03074156 A1

Amended claims have been filed on 10 May 2004.

New independent claim 1

D1 is considered to represent the closest prior art. From D1 a deliquidizer (S), acting as a pre-separator (see page 7, lines 28-31), is known, where liquid is separated from a multiphase flow (see page 7, line 18 - page 11, line 6). The fluid is set into rotation so that it is separated in a central zone along the longitudinal axis, which central zone in substance contains gas, and in an outer annular zone against the inside of the outer wall, which outer zone in substance contains liquid. An outlet means for gas is arranged leading from the central zone, and an outlet means for liquid is arranged leading from the outer zone. The deliquidizer functions according to a cyclone principle, see figures 1-3. The deliquidizer further comprises an, in substance, pipe-formed casing arranged to constitute a part of the inlet pipeline, a spin element (e.g. 1) for rotation of the fluid flow is located at the upstream end of the casing. Further, the deliquidizer in D1 comprises an outlet means for gas, which outlet means has a central, axial passageway (20) for the gas,

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

and an outer surface that together with the inner surface of the casing (5) forms an annulus for inflow of liquid. A barrier is formed at the downstream end of the element for the liquid where anti-spin elements are also arranged (see page 9, lines 25-29).

Further, the assembly comprises an outlet for liquid comprising an upwards open vessel that is arranged at the downstream end of the casing, which outlet means is arranged for taking up liquid that flows into the annulus and flows down into the vessel from the bottom region of the casing at the vessel opening, and falls down into the vessel from the region of said barrier.

What differs between the invention according to claim 1 and D1 is that the deliquidizer comprises a recirculation line between the vessel and the central section.

To arrange recirculation flows in separators is known for a person skilled in the art. For example, any of D2, D3 or D4 comprise recirculation flows. (See D2 figures 1, 2, claim 1 and the abstract; D3 column 2, lines 12-68, figure 1 and the abstract; D4 page 21, lines 1-20 and figures 5 and 6). However, there is nothing stated or hinted at in D1 that would make the skilled person want to look for the constructions in D2-D4. Especially since the invention and application concern different problems.

What also differs between the invention according to claim 1 and D1 is that the outlet means for gas is located at the downstream end of the casing.

In D1, it is located at the upstream end of the casing. There are known assemblies of the kind claimed in claim 1 that provide gas outlets at the downstream end of the casing. See for example D4, figures 5 and 6, where such an arrangement is apparent. However, there is nothing stated or hinted at in D1 that would make the skilled person want to arrange the outlet means for gas at the downstream end.

What further differs is that the deliquidizer is placed within the further separation equipment and constitutes an extension of the inlet. Nothing is stated or hinted at in D1 concerning how the

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

deliquidizer should be arranged with regard to the further separation.

Therefore, the invention is novel and considered to involve an inventive step.

Thus claims 2-4 are also novel and inventive.

Also what is claimed in claim 5 is new and considered to involve an inventive step.

The invention is industrially applicable.

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Claims

- 5 1. Assembly to separate out liquid from a multiphase fluid flow, comprising a scrubber, a column, a separator or other conventional separation equipment combined with a deliquidizer that is connected as the preseparator to the fluid inlet, in which deliquidizer fluid flow is set into rotation so that it is separated in a central zone along the
10 longitudinal axis, which central zone in substance contains gas, and an outer annular zone against the inside of the outer wall, which outer zone in substance contains liquid, from which central zone an outlet means for gas is arranged and from which outer zone and outlet means for liquid is arranged, in that the deliquidizer is functioning according to a cyclone principle,
15 characterized in that the assembly is comprising a deliquidizer with
an in substance pipe formed casing arranged to constitute a part of the inlet pipeline proper or the inlet, in that a spin element for rotation of the fluid flow is located at the upstream end of the casing,
an outlet means for gas comprising an outlet element located at the downstream
20 end of the casing, which outlet means has a central, axial passage way for the gas, and an outer surface that together with the inner surface of the casing forms an annulus for inflow of liquid, in that a barrier is formed at the downstream end of the element for the liquid, and optionally an antispin element is arranged at the downstream end of the gas outlet means,
25 an outlet means for liquid comprising an upwards open vessel that is arranged at the downstream end of the casing, or at the upstream end for main flow direction upwards, which outlet means is arranged for taking up liquid that flows into the annulus and partly flows down into the vessel from the bottom region of the casing at the vessel opening, and partly falls down into the vessel from the region at said barrier, and
30 an upper part of the outlet vessel and a central section of the inlet spin element upstream end have been connected together by use of a line, optionally with a regulation valve in the line, for recirculation of gas that can be entrained by liquid that flows or falls down into the vessel, in that the spin element has a central void space and is provided with a number of openings for outflow of recirculated gas from the void space, which
35 deliquidizer is placed within the further separation equipment and constitutes an extension of the inlet.
2. Assembly according to claim 1,

characterized in that the deliquidizer (1) is arranged within the further separation equipment and has main flow direction vertical upwards.

3. Assembly according to claim 1,

5 characterized in that the deliquidizer (1) is arranged within the further separation equipment and has main flow direction vertical downwards.

4. Assembly according to claim 1,

10 characterized in that the deliquidizer (1) is arranged horizontally and is placed within the further separation equipment and constitutes an extension of the inlet thereto.

5. Arrangement to separate out liquid from a multiphase fluid flow, comprising a scrubber, a column, a separator or other conventional separation equipment combined with a deliquidizer that is connected as the pre-separator to the fluid inlet, in which

15 deliquidizer fluid flow is set into rotation so that it is separated in a central zone along the longitudinal axis, which central zone in substance contains gas, and an outer annular zone against the inside of the outer wall, which outer zone in substance contains liquid, from which central zone an outlet means for gas is arranged and from which outer zone and outlet means for liquid is arranged, in that the deliquidizer is functioning according to a cyclone principle, which deliquidizer (1) is placed outside or within the further separation equipment,

20 characterized in that the deliquidizer is arranged with the main flow direction vertical upwards, in that the deliquidizer is comprising

25 an outer casing outside the gas/liquid separation pipe, to collect separated liquid, and

an outer cone for the gas outlet pipe, contributing to turning the liquid flow 180 ° related to the main flow direction.